Design and Analysis of Algorithms (CSC-303)
Tribhuvan University
Institute of Science and Technology
Soch College of Information technology

Course Title: Design and Analysis of Algorithms
Course no: CSC-303 ---------- Full Marks: 80+20
Credit hours: 3 ---------- Pass Marks: 32+8
Nature of course: Theory (3 Hrs.)
Course Synopsis: Methods and tools for analyzing different algorithms. Different approaches of designing efficient algorithms like divide and conquer paradigm, greedy paradigm, dynamic programming. Algorithms pertaining various problems like sorting, searching, shortest path, spanning trees, geometric problems etc. NP-complete problems.

Goal: Competency in analyzing different algorithms encountered. Ability to conquer the problem with efficient algorithm using the algorithm development paradigms.

Course Contents:

Unit 1:---------- 10 Hrs.
1.1 Algorithm Analysis: worst, best and average cases, space and time complexities. Mathematical background: asymptotic behavior, solving recurrences.
1.2 Data Structures Review: linear data structures, hierarchical data structures, data structures for representing graphs and their properties. Search structures: heaps, balanced trees, hash tables.

Unit 2:---------- 14 Hrs.
2.1 Divide and Conquer: Concepts, applications, sorting problems(quick, merge), searching (binary), median finding problem and general order statistics, matrix multiplications.
2.2 Greedy Paradigm: Concepts, applications, Knapsack problem, job sequencing, Huffman codes.
2.3 Dynamic Programming: Concepts, applications, Knapsack problem, longest common subsequence, matrix chain multiplications.

Unit 3:---------- 21 Hrs.
3.1 Graph Algorithms: breadth-first and depth-first search and their applications, minimum spanning trees (Prim's and Kruskal's algorithms), shortest path problems (Dijkstra's and flyod's algorithms), algorithm for directed acyclic graphs (DAGs).
3.2 Geometric Algorithms: Concepts, polygon triangulation, Convex hull computation.
3.3 NP Completeness: Introduction, class P and NP, cooks theorem, NP complete problems: vertex cover problem.
3.4 Introductions: Randomized algorithms concepts, randomized quick sort, approximation algorithms concepts, vertex cover problem.

Textbook:
T.H. Cormen, C.E. Leiserson, R.L. Rivest, and C. Stein, Introduction to Algorithms, 2nd Edition, MIT Press, 2001 ISBN: 0-262-530-910.

Reference:
G. Brassard and P. Bratley, Fundamentals of Algorithmics, Prentice-Hall, 1996 ISBN: 0-13-335068-1.